Benefit Cost Analysis of innovation packages to reduce the use of synthetic pesticides: the cases of combined insect-proof nets with Neem and Carapa oil for tomato protection

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Introduction

The agricultural sector in Côte d'Ivoire faces the continuous rise of urban and periurban agriculture and the excessive use of synthetic pesticides. This study estimates the effects of combined insect-proof nets with Neem and Carapa oil on the yield and the profitability of tomato cropping systems.

Mat & Methods

An experimental trial was composed of three types of pest management strategies : an untreated control, a treatment with Neen and Carapa oil, and two treatments which combined plants extracts and insects-proof nets. The double difference and cost-benefit analysis methods were used for the economic assessment.

Results

Our results revealed a significant difference in average yields between cropping systems. The yield with combined insect-proof nets with Neem and Carapa oil **is almost 3 times greater** than the control (16.1 t.ha^{-1} *vs* 6.6 t.ha^{-1}) in the dry season. There is no significant difference during the rainy season. **The Benefit:Cost ratio is 1.90:1 for Neem and Carapa oil only and 2.98:1 for Neem and Carapa oil with insect-proof nets**. The cost of the insect-proof nets cause the difference in the Benefit:Cost ratio.

Tab 1. Yield effects of pest management strategies (PSM) with Neem and Carapa oil combined with insect-proof nets.

	Rain season Yield (kg.ha^{-1})	Dry Season Yield (kg.ha^{-1})	Yield difference (kg.ha^{-1})	Difference-in-differences (DD)
Control (PSM0)	13,840	6,650	-7190 (-72%)	
Neem and Carapa oil only (PSM1)	15,130	7,612	-7518 (-75%)	-330 (-3%)
Neem and Carapa oil with insect-proof nets (PSM2)	14,215	16,910	2,695 (+27%)	9,885 (71%)

Source : Author's calculations.

Tab 2. Net Present benefit, and cost ratio of the different trials (2 cycles of production

	Control (PSM0)	Neem and Carapa oil only (PSM1)	Neem and Carapa oil with insect-proof net (PSM2)
Sum of discounted benefit (B)	1,064,960	2,495,926	1,452,0424
Sum of discounted costs (C)	1,236,627	1, 309,132	4, 861,913
Benefit Cost ratio B/C	0.86	1.90	2.98
Net Present Value (NPV) over 2 years (i%=10)	-764,485	675,433	2,000,015
NPV/C	-71%	51 %	41%

Source: Author's calculations.

The sensitivity analysis reveals that the tomato cropping systems, remain profitable even when farm-gate prices and production decrease by 20% and 30% respectively, and production costs increase by 30%.

Conclusions and perspectives

A tax policy considering iron frames and insect-proof nets as agriculture investments, would lower the tax rate from 20% to 5%, and therefore improve the Benefit:Cost ratio. A supply chain policy aiming at producing insect-proof net locally, would generate economies of scale and therefore lower the unit price of insect-proof nets. Other policies could consist in technology support and training. There is a need to perform a sustainability assessment of the Neem and Carapa oil supply chains.

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